

Article

Research on the Influencing Mechanism of Traditional Cultural Values on Citizens' Behavior Regarding the Reuse of Recycled Water

Kun Liu ¹, Hanliang Fu ^{1,*} and Hong Chen ²

¹ School of Management, Xi'an University of Architecture and Technology, Xi'an 710055, China; liukun@xauat.edu.cn

² School of Water Resources and Environment, China University of Geosciences, Beijing 100083, China; honchenxz@163.com

* Correspondence: fuhanliang@xauat.edu.cn

Received: 14 November 2017; Accepted: 9 January 2018; Published: 11 January 2018

Abstract: In order to explore the influence mechanism of traditional Chinese culture values on urban residents' acceptance of the reuse of recycled water, this paper selects interdependent self-constructional indicators representing the dependency relation between people as the representative of traditional culture values. In this paper, interdependent self-constructional indicators are introduced based on a technology acceptance model (TAM), in order to establish a hypothesis model. Following this, the writer conducts a study that shows the influence on the acceptance of recycled water through the formation of interdependent self-construction. Finally, the influence mechanism of traditional cultural values on citizens' behavior regarding the reuse of recycled water is determined. To start with, the writer verifies the reliability and validity of data from 584 samples, and then tests the goodness-of-fit between the sample data and the hypothesis model by AMOS21.0 (software). On this basis, the writer analyzes the direct and indirect influence through the hypothesis model and finds that the interdependent self-constructional intensity will accelerate the acceptance process of recycled water technology by positively influencing a change in the residents' attitudes to recycled water. The conclusion shows that traditional Chinese cultural values have a certain influence on urban residents' acceptance of the reuse of recycled water. Meanwhile, the writer clarifies the influence's mechanism.

Keywords: recycled water; cultural values; technology acceptance model; structural equation model

1. Introduction

As early as the end of the last century, some scholars have argued that the greatest obstacle to the extension of the recycled water project was not technological lagging, but the non-acceptance of the masses. Much subsequent research and many engineering examples have repeatedly indicated that the major factor of the recycled water project is the acceptance of the public [1]. For example, in the 1990s, the Tax Administration of Santiago of the United States planned to mix recycled water in drinking water, which caused a massive protest. Eventually the huge investment project failed halfway through. Similarly, in 2006, in Tuanba, Australia, a project to use recycled water to supplement dam water was strongly opposed by the residents. The slogan of the opposing masses was: "People do not drink polluted water" [2]. At that time, the storage of the dam was as low as 23% of its full capacity. However, 63% of the residents were against the project so that it was abolished. The public's acceptance degree to reclaimed water reuse is crucial to the successful implementation of the project [3,4]. Therefore, scholars have carried out a considerable number of studies to test the factors that affect the public's willingness to accept reclaimed water. Among them, Gibson & Burton's study has found that the use purpose of

reclaimed water and exposure extent to the human are important factors that affect public willingness to accept reclaimed water reuse [5]. People's nauseous reaction to reclaimed water is the so-called "yuck factor", which has also been found as an important indicator of the willingness of people to accept reclaimed water [6–8]. There are also other scholars devoted to discovering the differences at the individual level and predicting the reusability of reclaimed water. Some social demography statistical indicators, such as gender, age, and academic level, are found to be accurate indicators for predicting the degree of the public's perception regarding the risk of reclaimed water reuse [9]. In sociological studies, the aversion to reclaimed water has been found to be positively correlated with the degree of political conservatism [10]. In addition, there are also other individual and cultural values that affect the public attitudes toward the reuse of reclaimed water reuse. Environmental awareness and pro-environmental attitudes have been found in some studies to have predictive effects on the public willingness to accept reclaimed water reuse [1]. The degree of people's control over their perceptual behavior regarding their participation in reclaimed water reuse and the degree of trust in the provider of reclaimed water have also been found to both be important factors that affect the public's willingness to accept reclaimed water [11]. Scholars have also found some measures to increase the level of public trust in water management sectors and the acceptance degree of reclaimed water reuse, including environmental education [12], interaction between friends and family members, and opportunities created for public participation in reclaimed water reuse [13]. However, the influence of cultural values differing significantly between regions on public willingness to reuse reclaimed water remains a topic under-researched by scholars. In response to this problem, this article regards Chinese traditional cultural values as one of the potential influential factors that affect the public acceptance of reclaimed water reuse and then verifies its influencing role.

With over 5000 years of civilization, China's profound historical and cultural traditions undoubtedly exert a subtle influence on the natives. Therefore, the Chinese history and culture should be considered as factors for driving Chinese decision-making. Cultural values, as the core of traditional culture, are the beliefs shared and advocated by most members of a society. Additionally, they will indirectly affect the beliefs and the decision-making of the members of the society [14]. For recycled water, on the one hand, it is good for environmental protection to decrease waste water discharge. On the other hand, recycled water as a new technology will undoubtedly have potential risks for users for various reasons [15–18]. Therefore, recycled water use is an action that is good for society but harmful to oneself. When making a decision on whether to use recycled water, what kind of choice will the people under the influence of traditional Chinese cultural values make? What role does traditional Chinese culture value play in the public's decision-making? To solve this problem, this part of the study takes into account the influence of traditional cultural values on decision making with a view to providing new ideas for Chinese consumers to accept and use reclaimed water. Chinese traditional culture stems from the cultural intersection of Confucianism, Buddhism, and Taoism, but these three thoughts emphasize the harmony between the individual and others and between individuals and the environment. Under the influence of this traditional culture, it is natural for the Chinese to define their own uniqueness, that is, to regard their self as a part of the interpersonal relationship surrounding it [19]. Such an interpersonal relationship with Chinese characteristics is defined as "Guanxi" [20] in latter studies. In contrast, Western cultural values put more emphasis on individual independence and encourage individuals to develop and express their own unique personalities [21]. The studies by Markus and Kitayama have also confirmed the differences between individual values under the influences of Oriental and Western cultures [22], and it has been found that the people under the influence of Oriental culture represented by Chinese culture generally show stronger collectivism, while most individuals coming from a Western culture background show individualism. The cultural value types of individuals under the influence of different cultures from the East and West are distinguished by defining self-constructional indicators that represent the degree of difference and connection between the self and others. Individuals under the influence of oriental culture are more likely to show an interdependent self-construction; they will feel that they have a close connection

with others and will also regulate their behavior according to their relationships with others and to situational factors. Individuals under the influence of Western culture will show a more independent self-construction, which emphasizes self-independence [22]. The self-construction theory has been proposed and widely used in social psychology, organizational behavior, consumer psychology, and other fields of studies. Among them, interdependent self-construction is reflected [23,24] by cultural values at the individual level in many studies because of its connection with Chinese traditional cultural values. Therefore, we took interdependent self-construction as a concrete measurement index of Chinese traditional cultural values and considered the actual situation of the reuse of recycled water in China at present, and then selected five non-potable usages of recycled water that have the highest contact frequency with residents and the largest scope of application. These usages include residential toilet flushing, urban road sprinkling, firefighting, residential greening, and car washing. The degree of acceptance from the residents based on the above usages mentioned was measured and taken as dependent variables [25]. Based on this, we carried out our study on the influence of traditional Chinese cultural values on residents' willingness to accept reclaimed water.

2. Theoretical Model

Along with the shortage of water resources and the destruction of the water environment, human beings are themselves the initiator of various problems that they currently face affecting the sustainable development of the environment. However, this does not mean that nothing can be changed. With the development of science and technology, high-tech products, including recycled water technology, are being rapidly developed and widely used for natural environmental protection to effectively reduce the impact of human activities [26]. However, for potential consumers, recycled water is no doubt a new kind of product, and people lack an understanding of recycled water, as there is still no fixed consumption concept of it. However, recycled water is of vital importance for human survival and development, and it is estimated that humans will have to use recycled water sooner or later. Therefore, it is important for market managers to find the most suitable way to promote recycled water and make recycled water become more acceptable to residents [27,28]. Based on this, this research takes into account the characteristics of recycled water as a new technology [29,30], and the technology acceptance model (TAM), the theoretical model most widely used in technology acceptance research and which has the best explanation effect, has been introduced into the research field of behavior with respect to recycled water in order to simulate the process of residents' technology acceptance of recycled water.

Technology acceptance model (TAM). Davis drew on the related content of self-efficacy theory and the cost-benefit paradigm based on the theory of planned behavior and took "residents think that the use of new technology will make their lives and work better to a large extent" and "the trade-off of the difficulty level in using this technology on the basis of perceived benefits" into consideration in the study of the residents' technology acceptance. They used Perceived Usefulness and Perceived Ease of Use as its measuring indicators and put forward a TAM on this basis [31,32]. The model was originally used to find the reasons why computers were widely accepted. After more than 20 years of development and repeated verification, the model has been widely applied to explain humans' acceptance of new technology in various fields. It can even be argued that, if the researchers do not understand the TAM, it will mean that they lack a comprehensive understanding of the study history of technology acceptance [33]. The logic frame of TAM is illustrated in Figure 1.

Considering that the current promotion of recycled water in China is still at an early stage and is gradually known as a new technology, TAM is suitable for research on the acceptance process of recycled water technology with technical product attributes. The attributes of recycled water as a new technology product undoubtedly make the research and exploration of residents' willingness to reuse recycled water intersect with the technology acceptance research field. Meanwhile, the introduction of TAM—one of the most widely used and successful classical theoretical models in technology

acceptance and recycled water acceptance—can well simulate the residents' recycled water technology acceptance process.

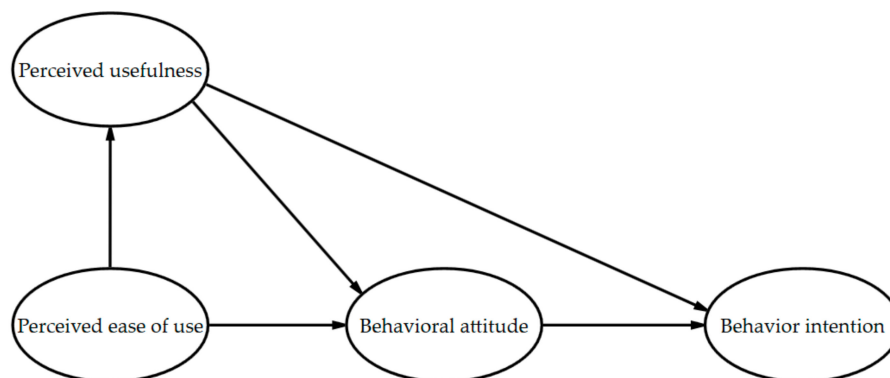


Figure 1. The technology acceptance model (TAM) logic frame diagram.

Introducing Traditional Chinese Cultural Values for the Expansion of Recycled Water Reuse TAM. Considering that recycled water has a positive externality of environmental protection that benefits society, but that there are some potential risks to users, individuals' trade-off for their own interests and the interests of others is undoubtedly important in the specific decision-making of potential users. Many studies have also shown that, in the field of environmentally friendly decision-making and in the green consumption field, similar to recycled water use, cultural values will have a great impact on final decision-making [34]. Following this, for the people who are raised in a traditional Chinese culture, the profound cultural imprint will inevitably affect the acceptance and decision-making of recycled water. Will new problems appear under Chinese cultural traditions during the process of recycled water promotion? In order to better solve this problem, we should first use a suitable scale to measure the influence of traditional Chinese culture on individuals; here, self-construction is one of the best choices. According to Markus' definition, self-construction is the degree to which one differs from, and interacts with, others [22]. Therefore, self-construction can be divided into interdependent self-construction and independent self-construction. People with an interdependent self-construction always feel closely related to others and will regulate themselves using their relationship to others and situational factors. Independent self-construction is defined as the state of being independently self-separated in a social context. Since self-construction was introduced into the consumption behavior research field in the 1990s, it has become one of the most popular research points in that field. People affected by Eastern culture, represented by Chinese culture, generally show a more interdependent self-constructional tendency, while individuals with an interdependent self-construction tend to exhibit a stronger collective consciousness, altruistic tendencies, and tend to take into account the interests of others while meeting their own needs. Therefore, this research selects the intensity of interdependent self-construction as a specific measurement indicator for the influence level of traditional cultural values on individuals. Consequently, the following assumptions can be drawn.

Assumption 1. *The strength of interdependent self-construction will positively affect people's usefulness perception of recycled water.*

The attitude on recycled water represents potential consumers' likes and dislikes for recycled water. Individuals with interdependent self-constructions tend to associate their own interests with the interests of others [35], will show more altruistic attributes in their behavior, and are more likely to conform to the decision-making of social mainstream ethics [36]. Therefore, considering that the reuse of recycled water helps protect the environment and benefits society, and that it is vigorously advocated, we put forward the following assumptions.

Assumption 2. *The strength of interdependent self-construction will positively affect people's attitude to recycled water.*

After introducing the traditional Chinese culture value to extend the acceptance model of recycled water technology, the hypothetical model is illustrated in Figure 2.

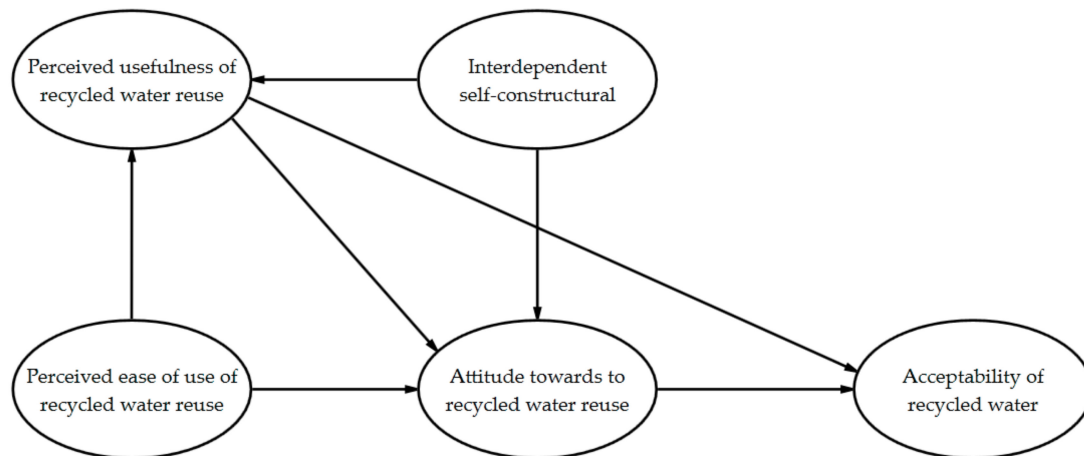


Figure 2. The expansion TAM frame diagram.

In addition, in order to determine the influence effect and influence mechanism of traditional cultural values on the acceptance of recycled water, the indirect influence effect of interdependent self-constructural indicators for the acceptability of recycled water should also be verified. We therefore put forward the following three path constructions.

Assumption 3. *The residents' interdependent self-construction will indirectly influence their acceptability of recycled water by positively influencing their usefulness perception of recycled water.*

Assumption 4. *The residents' interdependent self-construction will indirectly influence their acceptability of recycled water by positively influencing their attitudes toward recycled water.*

Assumption 5. *The residents' interdependent self-construction will indirectly affect their acceptability of recycled water by positively affecting, in turn, their perceived usefulness of recycled water and their attitudes toward recycled water.*

3. Questionnaire Design and Investigation Method

3.1. Questionnaire Design

When designing the questionnaire, in order to improve the validity and reliability of the questionnaire as far as possible, the writer tried to find classic relevant questionnaires in the related fields or others that had been successfully applied in related studies and modified it for the purposes of this study. All data are measured with a Likert 7 scale metric.

Attitudes Toward Recycled Water (ATT). The questionnaire adopts a semantic differential method for measurement, providing several groups of words representing both positive and negative attitudes for the participants to choose from, with negative words on the left and positive words on the right. "1" represents a very negative attitude toward recycled water; "7" indicates a very positive attitude. The measurement table for attitude toward recycled water is shown in Table 1 below.

Table 1. Measurement table for attitude toward recycled water. ATT: attitudes toward recycled water.

Latent Variable	Conceptual Interpretation	Answer Rules	Question No.	Question Item
Attitude toward recycled water	What do you think of recycled water?	Result close to the left means the attitude is close to the description on the left;	ATT2	Not desirable—Desirable
		Result close to the right, likewise	ATT3	Unpleasant—Pleasant
			ATT4	Unfavorable—Favorable

Note: The design of this part of the questionnaire refers to research [37].

Recycled water reuse perceived usefulness (PU). The use of recycled water can protect the environment and can improve public welfare and often requires collective action for recycled water to really play a substantive role. Therefore, before people choose to take this altruistic action, they often tend to doubt “whether other people will use recycled water” or “whether my use of recycled water will work on the environment”. The expectation that this behavior can improve the environment and benefit society can often provide part of the motivation for people to use recycled water. Therefore, this part of the questionnaire takes the public’s evaluation as the measurement standard for perceived usefulness in order to evaluate whether it is useful for improving water resources and the water environment. The measurement table for perceived usefulness of recycled water is shown in Table 2 below.

Table 2. Measurement table for perceived usefulness (PU) of recycled water.

Latent Variable	Conceptual Interpretation	Question No.	Question Item
Perceived usefulness of recycled water	The role of using recycled water	PU1	My reclaimed water reuse can reduce the consumption of water resources.
		PU2	My reclaimed water reuse can protect our environment.
		PU3	My reclaimed water reuse can create a better environment for our future generations.

Note: The design of this part of the questionnaire refers to research [38].

Perceived ease of use of recycled water (PEOU). The perceived ease of use reflects the difficulty level of recycled water use reviewed by the individuals, whose definition is similar to that of the perceived behavioral control. Due to individual knowledge, skills, and other self-factors, and due to time, resources, and other external factors, different people will have different difficulty degree perceptions of the use of recycled water. The measurement table for perceived ease of use of recycled water is shown in Table 3 below.

Table 3. Measurement table for perceived ease of use (PEOU) of recycled water.

Latent Variable	Conceptual Interpretation	Question No.	Question Item
Perceived ease of use of recycled water	Degree of difficulty of the use of recycled water	PEOU1	I can use recycled water as long as I want to use recycled water.
		PEOU2	I can distinguish facilities using recycled water.
		PEOU3	It is convenient for me to use recycled water.

Note: The design of this part of the questionnaire refers to [39].

Acceptability of Recycled Water (ACC). In the selection of measurement indicators of the public’s acceptance of recycled water, the classification of sewage recycling types in the city was used, and miscellaneous city uses closely linked to city residents and facilitating association were selected as measurement indicators of the acceptability of recycled water. The measurement table for acceptability of recycled water is shown in Table 4 below.

Table 4. Measurement table for the acceptability of recycled water (ACC).

Latent Variable	Conceptual Interpretation	Question No.	Question Item
Acceptability of recycled water	Acceptance level of different recycled water purposes	ACC1	Use recycled water for residential toilet flushing.
		ACC2	Use recycled water for urban road sprinkling.
		ACC3	Use recycled water for firefighting.
		ACC4	Use recycled water for residential greening.
		ACC5	Use recycled water for car washing.

Interdependent Self-Construction (ISC). We described above that self-construction is divided into independent and different types but mainly studied the influence of the intensity of interdependent self-construction on behavior with respect to recycled water. Consequently, that part of questionnaire drew on Laokefu's measurement questionnaire on interdependent self-construction. At the same time, since the individuals of interdependent self-construction consider the surrounding environment and the views of people around during selection, people with stronger interdependent self-construction will be less self-centered and contribute more to others. Consequently, the questionnaire design drew on part of the question items regarding personal norms in the altruism questionnaire designed by Clark. The measurement table for self-construction is shown in Table 5 below.

Table 5. Measurement table for independent self-construction (ISC).

Latent Variable	Conceptual Interpretation	Question No.	Question Item
Interdependent self-constructural	Degree of difficulty of the use of recycled water	ISC1	I can use recycled water as long as I want to use recycled water.
		ISC2	I can distinguish facilities using recycled water.
		ISC3	It is convenient for me to use recycled water.

3.2. Investigation Method

Being the ancient capital of the 13 dynasties, Xi'an is an important birthplace of Chinese civilization, and it is geographically located in the center of the People's Republic of China. We therefore selected Xi'an as the acquisition point for survey data. With its limited research energy and capacity, it is representative of the influence of Chinese traditional cultural values on the reclaimed water reuse of residents. In the early stage of the survey, 10 surveyors were trained to have the relevant fundamental knowledge about the items contained within the survey. From 16 September to 16 October 2016, the survey was conducted in streets, central squares, shopping malls, and parks randomly selected from all districts and counties. The survey locations are shown in Figure 3.

Altogether 714 questionnaires were distributed and 584 valid questionnaires were retrieved, with a validity of 82%. A basic description of survey participants is given in Table 6. Each survey participant was given a souvenir.

Table 6. Research sample description table.

Variable Name	Description of Variables	Sample Number Statistics
Age	43 and above	120
	Under 43	454
Gender	Male	127
	Female	447
Education	Bachelor degree and above	301
	Below bachelor degree	280

Note: Personal privacy problems were not mandatory, as it may have been too troublesome for participants to write them down, so some questions were not answered.

3.3. Questionnaire Effectiveness Control Measures

After the completion of the questionnaire, in order to minimize the data interference caused by both misunderstandings and random answers from participants, several people were invited by the author to fill out the survey as a test, in order to ensure that the questionnaire was easy to understand and could be understood by all kinds of people. On the first page of the questionnaire, the purpose of this survey was introduced to the public, and the specialized term “recycled water”, unavoidable in the questionnaire, was described in easily understandable language combined with images. Prior to the survey, surveyors underwent unified training and were required to wear uniforms and real-name survey documents. The surveyors clearly informed the participants, prior to the survey, that the results were for research purposes only. When the participants were filling out the surveys, the researchers remained neutral and did not speak to the participants. The participants were expected to answer honestly. Therefore, during the survey, the researchers randomly adjusted the order of the questions three times in order to reduce the possibility that answers were influenced by the order of the research questions. For the recovery of the questionnaire, the surveyors were required to carefully check whether there were any blanks in the questionnaire. If this was the case, they asked the participant to fill those sections in, except for personal privacy problems.

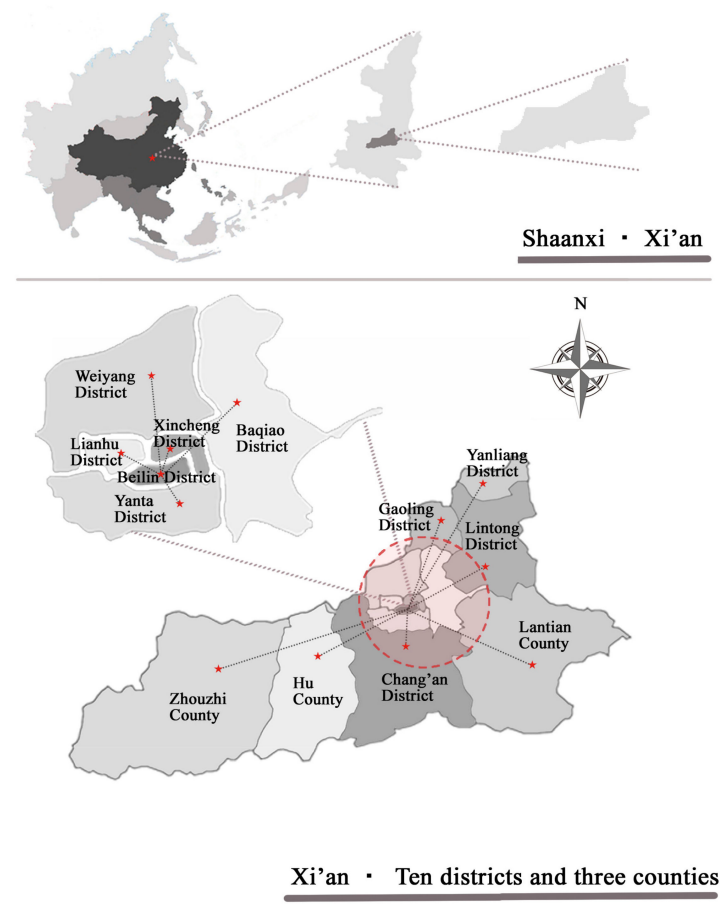


Figure 3. Research sites.

4. Data Checking and Model Fitting

4.1. Sample Number Estimation

During the establishment of the structural equation model, on the advice of Bentler, in order to ensure the credibility of the structural equation model, the samples should be randomly divided into

two parts, one for the development of the model and the other for the repeated validation of the model. In this research, therefore, 584 valid samples were divided into two parts [40]. Finally, 292 samples were used to develop the model, and the other 292 samples were used for the repeated verification of the model. According to the suggestion of Hair et al., the ratio of the samples to the observed variables of the structural equation model should be between 1:10 and 1:15, and sample numbers between 200 and 400 are appropriate [41]. In total, five latent variables with 19 questions were included, so 292 samples were used for the development of the model to meet the sample number requirements.

4.2. Reliability and Validity Analysis

In order to judge whether the reliability of the questionnaire met the relevant standards, Cronbach's α coefficient was used. First, the questions that did not meet the reliability requirements were eliminated, and the reliability of the remaining questions was then analyzed again. The results are shown in Table 7. As shown in Table 7, the Cronbach's α values are beyond the standard of 0.7, demonstrating that the questionnaire was of sound reliability. In terms of the validity test, we used the test items most widely used in the field to carry out the test, namely, the convergent and discriminant validity.

Table 7. Reliability convergent validity table.

Latent Variable	Title	Estimation of Parameter Significance				Factor Loading	Question Reliability	Composite Reliability	Convergent Validity
		Unstd	S.E.	t-Value	P	Std.	α	CR	AVE
Acceptability of Recycled Water	ACC3	1.000				0.899	0.808	0.957	0.816
	ACC4	0.998	0.042	23.983	***	0.900	0.810		
	ACC2	1.072	0.043	25.121	***	0.917	0.841		
	ACC1	0.988	0.040	24.407	***	0.907	0.823		
	ACC5	0.978	0.042	23.483	***	0.893	0.797		
Interdependent Self-constructural	ISC3	1.000				0.622	0.387	0.760	0.516
	ISC2	1.173	0.138	8.504	***	0.779	0.607		
	ISC1	1.200	0.139	8.601	***	0.745	0.555		
Perceived Usefulness	PU3	1.000				0.863	0.745	0.903	0.757
	PU2	1.045	0.055	18.920	***	0.895	0.801		
	PU1	0.873	0.049	17.991	***	0.852	0.726		
Attitudes toward Recycled Water	ATT3	1.000				0.883	0.780	0.916	0.785
	ATT2	1.000	0.049	20.453	***	0.889	0.790		
	ATT1	0.994	0.049	20.362	***	0.886	0.785		
Perceived Ease of Use	PEOU3	1.000				0.797	0.635	0.827	0.614
	PEOU2	1.045	0.088	11.839	***	0.761	0.579		
	PEOU1	1.075	0.090	12.004	***	0.792	0.627		

Note: *** Significant at $P < 0.001$.

In the convergence validity test, Fornell's and Larcker's recommendations were followed. Therefore, the standardized factor loading, combined reliability (CR), average variance extraction (AVE), and other indicators were noted (specific test values are shown in Table 7). According to the test results in Table 7, the standardized factor loading are all greater than 0.6, and non-standardized tests are all significant. CR values are greater than 0.7, in line with the recommended standard of Fornell, Larcker, and Hair. At the same time, the AVE values are greater than or close to 0.5, also in line with Fornell's and Larcker's recommended standard. It can be concluded that each latent variable has good convergent validity [42].

In terms of the discriminant validity test, according to the recommendations of Fornell and Larcker, it is only necessary to determine whether the square root of the AVE value corresponding to the latent variable is greater than all of its other latent variables and other correlation coefficients [42]. Therefore, from Table 8, it can be seen that the latent variables of the questionnaire have better discriminant validity.

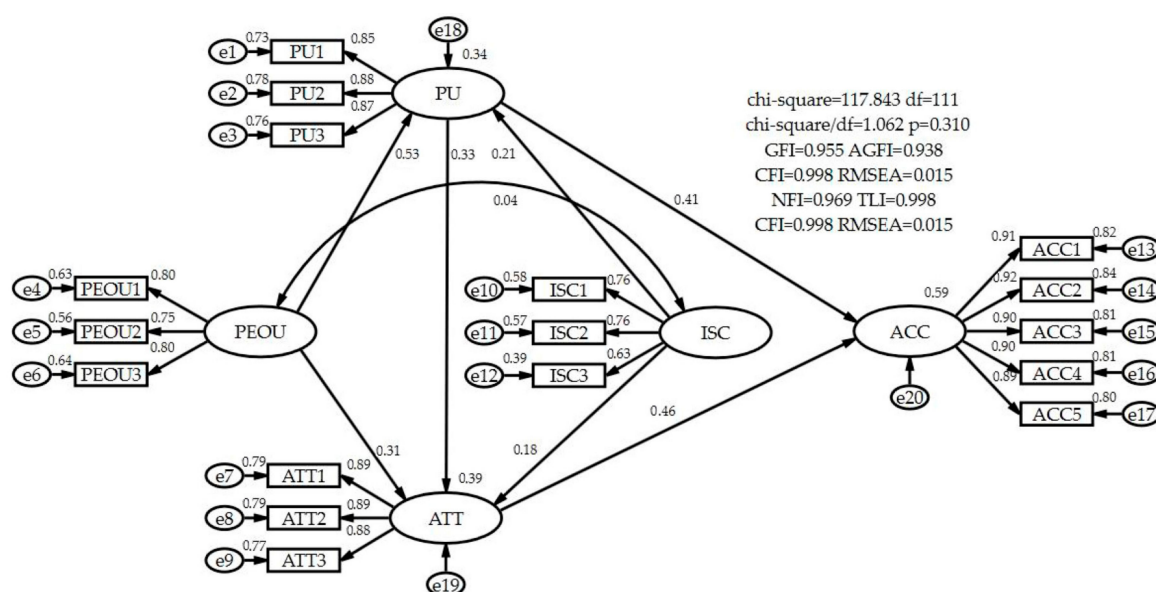
Table 8. Discriminant validity table of TAM model.

	AVE	Perceived Ease of Use	Attitudes toward Recycled Water	Perceived Usefulness	Interdependent Self-Construction	Acceptability of Recycled Water
Perceived ease of use	0.614	0.784				
Attitudes toward Recycled Water	0.785	0.499	0.886			
Perceived usefulness	0.757	0.540	0.541	0.870		
Interdependent self-construction	0.516	0.041	0.269	0.227	0.718	
Acceptability of recycled water	0.816	0.465	0.684	0.662	0.254	0.903

Note: The bold figures are the square root of AVE between the corresponding latent variables and the others are Pearson correlation values between latent variables.

4.3. Integral Fitting Analysis

On the basis of the verified reliability and the validity of the data as well as the number of samples satisfied with the requirements, this section's model starts with the data of the 292 samples using AMOS21.0 (see Figure 4). Additionally, the simulation of the model is verified. Following this, the other 292 samples are used for repeated verification of the development model, and on this basis, Assumptions 1–5 are demonstrated. The intermediary effect in the whole model was analyzed.

**Figure 4.** Recycled water TAM under the influence of traditional culture.

When the structural equation is used to verify the theory, it is necessary to test the goodness-of-fit of the model first. A better goodness-of-fit indicates that the simulation model is closer to the actual situation of the sample. A review article on many studies using a structural equation as a research method, published by Jackson et al. in 2009, shows that the fitting index commonly reported in various studies amounts to a total of 10 indicators, namely, chi-square, degrees of freedom (df), chi-square/df ratio, root-mean-square error of approximation (RMSEA), standardized RMR; goodness-of-fit index (GFI), adjusted GFI, normed fit index (NFI), Tucker–Lewis index (TLI), and comparative fit index (CFI) [43]. Referring to this conclusion, this study also uses the above 10 indicators in the report on the model fitting. Specific fit indexes are shown in Table 9 below.

Table 9. Model fitting table.

Fitting Index	Chi-Square	df	Chi-Square/df	RMSEA	SRMR	GFI	AGFI	NFI	TLI	CFI
Measurement value	117.843	111	1.062	0.015	0.029	0.955	0.938	0.969	0.998	0.998

Therefore, the structural equation model has good fitting indexes, indicating that the model fits the data well.

4.4. Cross-Validation Analysis

To verify whether the structural equation model has good cross-validity, the group comparison method was applied to bring the previously randomly distributed group (292 samples) into the model and to compare it with the present model so as to determine whether the structural equation model has cross-group consistency. In the cross-group consistency test of the model, we used a tight replication strategy. The specific test index includes whether the factor loading (measurement weights) is congruent, whether the path coefficients (structural weights) are congruent, whether the factor co-variances (structural co-variances) are congruent, and whether the structural residuals and measurement residuals are congruent. On the basis of the assumption that the model is correct, assuming first that the factor loading of the two groups of models is consistent, the test result is $P = 0.933$, which is much higher than 0.05. It can therefore be proven that the factor loading of the structural model has cross-group consistency. Following this, in addition to the assumption that the factor loading is consistent, assuming that the path coefficients are consistent, the test result is $P = 0.552$, which is also higher than 0.05. Therefore, the path coefficient of the structural model has cross-group consistency. On the basis of the above assumptions, assuming that the factor co-variances are congruent, $P = 0.431$, which is higher than 0.05. Therefore, the factor covariance of the structural model has cross-group consistency. Finally, on the basis of the above assumptions, assuming that the structural residuals and measurement residuals of the model are both congruent, $P = 0.392$ and 0.315 , respectively, both of which are higher than 0.05; therefore, the structural residuals and measurement residuals of the structural model also have cross-group consistency. In the group consistency test under the strict strategy, various indexes of the model are congruent, so that the structural model has cross-group consistency between the two groups. In other words, the structural equation model passes the cross validity test, and the settings of the model are correct.

5. Data Analysis and Assumption Test

5.1. Path Coefficient and Assumption Test

On the basis of the verification and model fitting tests, the path coefficients of the direct influence effect on different latent variables were tested to verify that Assumptions 1 and 2 are true. Standardized path coefficients are shown in Table 10 below.

Table 10. Standardized path coefficient table.

Path Name	Standardized Estimated Value	Non-Standardized Estimated Value	Standard Error	t Value	P	Significance	Assumption Test
Interdependent Self-construction→Recycled water reuse perceived usefulness (PU, Perceived Usefulness).	0.209	0.200	0.061	3.276	0.001	Significant	Assumption 1 is tenable
Interdependent Self-construction→Recycled water reuse attitude	0.183	0.220	0.075	2.940	0.003	Significant	Assumption 2 is tenable

5.2. Mediation Effect and Assumption Test

As an important statistical concept, the mediation effect has many applications in many social sciences. Some scholars collected articles published in two top journals of social psychology from 2005 to 2009 and found that 59% and 65% of them used the mediation effect test [44], respectively. Studying the mediation effect can help researchers to more deeply understand what and how independent variables affect dependent variables. In the mediation effect test, the study followed Hayes's suggestion, and the bootstrap method was used for it [45].

We assume that 3, 4, and 5 represent three potential paths where interdependent self-construction affects the willingness to accept recycled water, namely, $ISC \rightarrow PU \rightarrow ACC$, $ISC \rightarrow ATT \rightarrow ACC$, and $ISC \rightarrow PU \rightarrow ATT \rightarrow ACC$. The bootstrap method will be used as follows to verify that the mediation effect exists in the three paths and to compare their mediation effects. Specific indexes are shown in Table 11 below.

Table 11. Test table of the mediation effect between interdependent self-construction and recycled water acceptability.

Path Name	Point Estimation	Coefficient Product		Bootstrap			
				BC 95% CI		Percentile 95% CI	
		Standard Error	Z Value	Minimal Value	Maximal Value	Minimal Value	Maximal Value
Indirect effects							
PU	0.113	0.042	2.690	0.042	0.217	0.037	0.207
ATT	0.111	0.046	2.413	0.034	0.219	0.028	0.209
PU & ATT	0.042	0.021	2.000	0.013	0.098	0.011	0.092
TOTAL	0.265	0.076	3.487	0.132	0.434	0.124	0.427
Contracts							
PU vs. ATT	0.002	0.060	0.033	−0.114	0.124	−0.115	0.123
PU vs. PU & ATT	0.071	0.033	2.152	0.021	0.158	0.013	0.141
ATT vs. PU & ATT	0.069	0.051	1.353	−0.026	0.175	−0.031	0.168

Note: BC is Bias-corrected; CI represents confidence interval; PU refers to path $ISC \rightarrow PU \rightarrow ACC$; ATT refers to path $ISC \rightarrow ATT \rightarrow ACC$; PU & ATT refers to path $ISC \rightarrow PU \rightarrow ATT \rightarrow ACC$; Samples are obtained by 5000 times of Bootstrap.

According to Table 11, the Z-values of the three paths are all greater than 1.96, which indicates that the mediation effect test of the three paths is significant via the coefficient product method. At the same time, through the bootstrap method, the minimal value and maximal value of the bias-corrected method and the percentile method do not contain 0. Therefore, the mediation effect of the three influence paths between the perceived ease of use of recycled water and the acceptability of recycled water is significant.

In addition, according to the comparison of the mediation effects of the paths in Table 11, path $ISC \rightarrow PU \rightarrow ACC$ and path $ISC \rightarrow ATT \rightarrow ACC$, as well as path $ISC \rightarrow ATT \rightarrow ACC$ and path $ISC \rightarrow PU \rightarrow ATT \rightarrow ACC$, do not show significant differences in their mediation effect (the Z-value is less than 1.96, and both the bias-corrected interval and the percentile interval contain 0). The effect of the path $ISC \rightarrow PU \rightarrow ACC$ is obviously stronger than that of the path $ISC \rightarrow PU \rightarrow ATT \rightarrow ACC$ (the Z-value is greater than 1.96, and the bias-corrected and percentile intervals do not contain 0).

6. Conclusions

This study introduces interdependent self-construction representing traditional Chinese cultural values as an extension of the model based on the classic theoretical framework of the TAM and establishes a structural equation model based on the research data. The model suitability test and cross validation test were conducted to verify the applicability of the model to the acceptance process of

recycled water technology. On this basis, and via the use of path coefficient and mediation effect tests, the acting effect and acting mechanism of traditional Chinese cultural values are determined from the acceptance process effect of recycled water technology. Our conclusions are below.

The extended TAM is able to explain the recycled water technology acceptance process. According to the validation process of Assumption 1, we found that the extended TAM has a good degree of fit with respect to the survey data. At the same time, according to the expansion TAM frame diagram, we found that the R^2 value representing the acceptance degree of the model's acceptance intention of recycled water is as high as 0.59, indicating that the model is able to explain acceptance intention. Meanwhile, through the path coefficient test, the path coefficients in the model are all significant. Therefore, the extended TAM is suitable for explaining and simulating the acceptance process of recycled water technology.

The interdependent self-construction intensity will accelerate the acceptance process of recycled water technology by positively influencing residents' attitudes toward recycled water and the perceived usefulness of recycled water. By determining the direct and indirect influence relations between different variables in the interdependent self-construction and in the TAM, we determined that the interdependent self-construction intensity will accelerate the acting path of the acceptance process of recycled water technology by positively influencing the residents' attitudes toward recycled water and its perceived usefulness. Traditional Chinese thoughts put the interests of others above one's own, and this is also a form of individual value (interdependent self-construction). This is of vital importance in increasing the residents' level of acceptance of recycled water, and its influence mechanism has been explained by scientific methods. Thus, the positive part of Chinese traditional culture still plays an important role in the promotion of recycled water, and it is also a new argument to help increase the public's acceptance level of recycled water from a cultural point of view.

Acknowledgments: This work was supported by the CES-Kingfar Excellent Young Scholar Joint Research Funding (CES-KF-2016-05).

Author Contributions: Hanliang Fu designed the research topic and drafted the manuscript; Kun Liu shared efforts in data analysis and provided suggestions to revise the paper. Hong Chen provided suggestions to revise the paper.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Dolnicar, S.; Hurlimann, A.; Grün, B. What affects public acceptance of recycled and desalinated water? *Water Res.* **2011**, *45*, 933–943. [[CrossRef](#)] [[PubMed](#)]
2. Dolnicar, S.; Hurlimann, A.; Long, N. The effect of information on public acceptance—The case of water from alternative sources. *J. Environ. Manag.* **2010**, *91*, 1288–1293. [[CrossRef](#)] [[PubMed](#)]
3. Kosovac, A.; Hurlimann, A.; Davidson, B. Water experts' perception of risk for new and unfamiliar water projects. *Water* **2017**, *9*, 976. [[CrossRef](#)]
4. West, C.; Kenway, S.; Hassall, M.; Yuan, Z. Why do residential recycled water schemes fail? A comprehensive review of risk factors and impact on objectives. *Water Res.* **2016**, *102*, 271–281. [[CrossRef](#)] [[PubMed](#)]
5. Gibson, F.L.; Burton, M. Salt or sludge? Exploring preferences for potable water sources. *Environ. Resour. Econ.* **2013**, *57*, 453–476. [[CrossRef](#)]
6. Qian, N.; Leong, C. A game theoretic approach to implementation of recycled drinking water. *Desalination Water Treat.* **2016**, *57*, 24231–24239. [[CrossRef](#)]
7. Leong, C. The Role of Emotions in Drinking Recycled Water. *Water* **2016**, *8*, 548. [[CrossRef](#)]
8. Wester, J.; Timpano, K.; Çek, D.; Broad, K. The psychology of recycled water: Factors predicting disgust and willingness to use. *Water Resour. Res.* **2016**, *52*, 3212–3226. [[CrossRef](#)]
9. Mankad, A.; Tapsuwan, S. Review of socio-economic drivers of community acceptance and adoption of decentralised water systems. *J. Environ. Manag.* **2011**, *92*, 380–391. [[CrossRef](#)] [[PubMed](#)]
10. Inbar, Y.; Pizarro, D.; Iyer, R.; Haidt, J. Disgust sensitivity, political conservatism, and voting. *Soc. Psychol. Personal. Sci.* **2011**, *3*, 537–544. [[CrossRef](#)]

11. Ormerod, K.J.; Scott, C.A. Drinking wastewater: Public trust in potable reuse. *Sci. Technol. Hum. Values* **2012**, *38*, 351–373. [\[CrossRef\]](#)
12. Fu, H.; Liu, X. A Study on the Impact of Environmental Education on Individuals' Behaviors Concerning Recycled Water Reuse. *Eurasia J. Math. Sci. Technol. Educ.* **2017**, *13*, 6715–6724. [\[CrossRef\]](#)
13. Nancarrow, B.E.; Leviston, Z.; Tucker, D.I. Measuring the predictors of communities' behavioural decisions for potable reuse of wastewater. *Water Sci. Technol.* **2009**, *60*, 3199–3209. [\[CrossRef\]](#) [\[PubMed\]](#)
14. Fu, H.; Liu, X. Research on the Phenomenon of Chinese Residents' Spiritual Contagion for the Reuse of Recycled Water Based on SC-IAT. *Water* **2017**, *9*, 846.
15. Zeng, Y.; Xie, Z.; Zou, J. Hydrologic and climatic responses to global anthropogenic groundwater extraction. *J. Clim.* **2017**, *30*, 71–90. [\[CrossRef\]](#)
16. Zeng, Y.; Xie, Z.; Yu, Y.; Liu, S.; Wang, L.; Jia, B.; Qin, P.; Chen, Y. Ecohydrological effects of stream-aquifer water interaction: A case study of the Heihe River basin, northwestern China. *Hydrol. Earth Syst. Sci.* **2016**, *20*, 2333–2352. [\[CrossRef\]](#)
17. Zeng, Y.; Xie, Z.; Yu, Y.; Liu, S.; Wang, L.; Zou, J.; Qin, P.; Jia, P. Effects of anthropogenic water regulation and groundwater lateral flow on land processes. *J. Adv. Model. Earth Syst.* **2016**, *8*, 1106–1131. [\[CrossRef\]](#)
18. Zhang, N.; Hu, Z.; Dai, D.; Dang, S.; Yao, M.; Zhou, Y. Unit Commitment Model in Smart Grid Environment Considering Carbon Emissions Trading. *IEEE Trans. Smart Grid* **2016**, *7*, 420–427. [\[CrossRef\]](#)
19. Miller, D. The Ethical Significance of Nationality. *Ethics* **1988**, *98*, 647–662. [\[CrossRef\]](#)
20. Yanjie, B.; Soon, A. Guanxi Networks and Job Mobility in China and Singapore. *Soc. Forces* **1997**, *75*, 981–1005.
21. Gao, L.; Zheng, X.; Yan, B. The Differences of Well-being between the East and the West: From the View of Self-construal. *Adv. Psychol. Sci.* **2010**, *18*, 1041–1045.
22. Markus, H.; Kitayama, S. Culture and the Self: Implications for Cognition, Emotion, and Motivation. *Psychol. Rev.* **1991**, *98*, 224–253. [\[CrossRef\]](#)
23. Singelis, T.M. Pancultural explanations for life satisfaction: Adding relationship harmony to self-esteem. *J. Personal. Soc. Psychol.* **1997**, *73*, 1038–1051.
24. Tung, R.L.; Baumann, C. Comparing the attitudes toward money, material possessions and savings of overseas Chinese vis-à-vis Chinese in China: Convergence, divergence or cross-vergence, vis-à-vis 'one size fits all' human resource management policies and practices. *Int. J. Hum. Resour. Manag.* **2009**, *20*, 2382–2401. [\[CrossRef\]](#)
25. Angelakis, A.N.; Gikas, P. Water Reuse: Overview of current practices and trends in the World with emphasis in EU. *Water Util. J.* **2014**, *6*, 67–78.
26. Vlek, C.; Steg, L. Human Behavior and Environmental Sustainability: Problems, Driving Forces, and Research Topics. *J. Soc. Issues* **2007**, *63*, 1–19. [\[CrossRef\]](#)
27. Liu, Z.; Xu, W.; Zhai, X.; Qian, C.; Chen, X. Feasibility and performance study of the hybrid ground-source heat pump system for one office building in Chinese heating dominated areas. *Renew. Energy* **2017**, *101*, 1131–1140. [\[CrossRef\]](#)
28. Ke, Z.; Johnson, L.; Prasad, V.; Wang, D. Big bluestem as a bioenergy crop: A review. *Renew. Sustain. Energy Rev.* **2015**, *52*, 740–756.
29. Ke, Z.; Zheng, G.; Saul, K.; Jiao, Y.; Xin, Z.; Wang, D. Evaluation of the multi-seeded (MSD) mutant of sorghum for ethanol production. *Ind. Crops Prod.* **2017**, *97*, 345–353.
30. Liu, Z.; Xu, W.; Qian, C.; Chen, X.; Jin, G. Investigation on the feasibility and performance of ground source heat pump (GSHP) in three cities in cold climate zone, China. *Renew. Energy* **2015**, *84*, 89–96. [\[CrossRef\]](#)
31. Liu, Z.; Li, H.; Liu, K.; Yu, H.; Cheng, K. Design of high-performance water-in-glass evacuated tube solar water heaters by a high-throughput screening based on machine learning: A combined modeling and experimental study. *Sol. Energy* **2017**, *142*, 61–67. [\[CrossRef\]](#)
32. Liu, Z.; Li, A.; Hu, Z.; Sun, H. Study on the potential relationships between indoor culturable fungi, particle load and children respiratory health in Xi'an, China. *Build. Environ.* **2014**, *80*, 105–114. [\[CrossRef\]](#)
33. Marangunić, N.; Granić, A. Technology acceptance model: A literature review from 1986 to 2013. *Univers. Access Inf. Soc.* **2015**, *14*, 81–95. [\[CrossRef\]](#)
34. Berenguer, J.; Corraliza, A.; Martín, R. Rural-Urban Differences in Environmental Concern, Attitudes, and Actions. *Eur. J. Psychol. Assess.* **2006**, *21*, 128–138. [\[CrossRef\]](#)
35. Gore, J.; Cross, S. Conflicts of Interest: Relational Self-construal and Decision Making in Interpersonal Contexts. *Self-Identity* **2011**, *10*, 185–202. [\[CrossRef\]](#)

36. Cojuharenco, I.; Shteynberg, G.; Gelfand, M.; Schminke, M. Self-Construal and Unethical Behavior. *J. Bus. Ethics* **2012**, *109*, 447–461. [[CrossRef](#)]
37. Tonglet, M.; Phillips, S.; Read, D. Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: A case study from Brixworth, UK. *Resour. Conserv. Recycl.* **2004**, *41*, 191–214. [[CrossRef](#)]
38. Han, H.; Hsu, T.; Sheu, C. Application of the Theory of Planned Behavior to green hotel choice: Testing the effect of environmental friendly activities. *Tour. Manag.* **2010**, *31*, 325–334. [[CrossRef](#)]
39. Lam, T.; Hsu, C. Predicting behavioral intention of choosing a travel destination. *Tour. Manag.* **2006**, *27*, 589–599. [[CrossRef](#)]
40. Bentler, P.M.; Bonett, D.G. Significance tests and goodness of fit in the analysis of covariance structure. *Psychol. Bull.* **1980**, *88*, 588–606. [[CrossRef](#)]
41. Hair, J.; Anderson, R.; Tatham, R.; Black, W. *Multivariate Data Analysis*, 5th ed.; Prentice Hall: Upper Saddle River, NJ, USA, 1998; pp. 677–679.
42. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [[CrossRef](#)]
43. Jackson, L.; Gillasp, A.; Purc-Stephenson, R. Reporting Practices in Confirmatory Factor Analysis: An Overview and Some Recommendations. *Psychol. Methods* **2009**, *14*, 6–23. [[CrossRef](#)] [[PubMed](#)]
44. Rucker, D.; Preacher, K.; Tormala, Z.; Petty, R. Mediation Analysis in Social Psychology: Current Practices and New Recommendations. *Soc. Personal. Psychol. Compass* **2011**, *5*, 359–371. [[CrossRef](#)]
45. Hayes, A. Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Commun. Monogr.* **2009**, *76*, 408–420. [[CrossRef](#)]



© 2018 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).